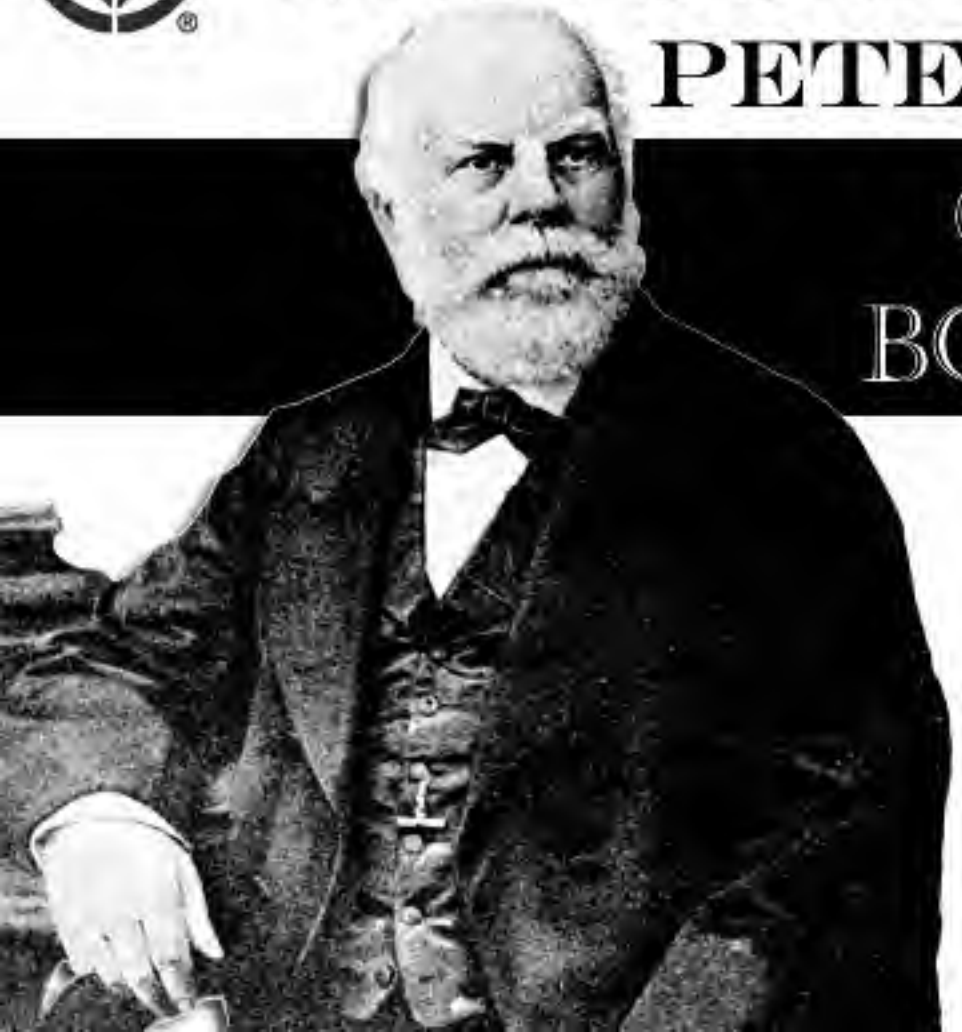
Missouri Botanical Garden
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George Engelmann Botanical Notebooks

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In the shallow and more rapid parts of Woburn Creek, and in Abajona River, the main source of Mystic Pond, near Boston; ~~+~~ always submerged in ½ to 2 feet of water, scattered over a clean gravelly bottom and

W. Boott.— Remarkable for its long flaccid leaves and the shorter spinules sometimes crest of the macrospores, which form sometimes crests, so that Duvien could compare it with I. riparia.

5. I. Bolanderi, Engelm. One of the smaller species with erect soft bright green tapering leaves to a fine point, 5 to 20 or 25 in number, 2 to 4½ inches long with thin walls and partitions, and generally not many stomata; sporangium broadly oblong, mostly without any spots, with a narrow velum; ligula triangular; macrospores 0.30 to 0.40 or rarely 0.45 mm thick, marked with minute low tubercles or warts, rarely confluent to wrinkles; microspores 0.026 to 0.031 mm long, generally spinulose; rarely, in the Rocky Mountain form, smooth, deep brown.— Am. Naturalist 8. 214. I. Californica Engelm, name only in Gray Man. l.c.

"A western mountain species, found gregarious in ponds and shallow lakes of the Sierra Nevada of California, northward to the Cascades and eastward to the Rocky Mountains: in little pools on meadows in the Upper Tuolumne valley 9 to 10,000 feet alt., on Mt Dana, on the Mono trail, in Mary's Lake near the Summit, 7000 feet alt., in small lakes about Cisco 4500 to 5000 feet alt. "mostly gregarious in mud covering gravel, in 1 or 2 feet of water" with Menyanthes trifoliata, ~~all by~~ H. Bolander; Ice-lake, near Soda Spring Station, 7500 feet alt. V. Englmann

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northward,— maturing in Aug. & Sept.— Near I. lacustris, with leaves as dark green and almost as rigid and with spores approaching it in size and sculpture, but readily distinguished by its stomata and by the spots on the sporangium; ♀ Some of the Uxbridge specimens, ~~tow~~ entirely submerged in 2 to 4 feet deep water, have slenderer and longer (even 12 inches) leaves. The trunk, mostly thick, 2-have once found 3-lobed. Germinating spores and young plantlets were found in June by Mr Durand, indicating germinating in Spring and early Summer.

57 ♀ must above ♀ from I. echinospora var. Braunii, with which smaller forms may possibly be confounded, it can always be known by the darker, stiffer leaves, and especially the characters of the spores, ~~will always distinguish it.~~

Farther northward, in Maine, I. W. Chickering and in Canada West, Crow River, Hastings County, J. Macoun (here in running water with Brasenia and Potamogeton ×), a form occurs with very few and apparently too weak bast bundles, an upper and a lower one stomata on leaves, and very pale spots on the sporangia and smooth microspores, which might be designated as var. Canadensis, but too little is known about it as yet, to form a definite opinion.

small type + + Velum complete

8. I. Engelmanni melanospora, Engelm. One of the smallest species, with a flat only slightly bilobed trunk; leaves few (5 to 10, 2 to 2½ inches long) distichous, slender, tapering, light green, spreading; sporangia orbicular or almost obcordate, ½ to 1 line long, entirely covered by the velum, unspotted;

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ligule short-triangular obtuse or about semi-orbicular; macro-
spores 0.35 to 0.45 mm in diam. ~~dark~~ roughened with distinct or rarely
somewhat confluent warts, dark coloured; microspores 0.028 to 0.031
mm long, smoothish or slightly papillose. — Transact. St Louis Ac. Sc.
3 p. 395 note.

Stone Mountain near Atlanta, Georgia, covering the bottom of shallow
naked
excavations on the solid granit surface a few inches deep and a few
feet in diameter, holding about one inch of light black soil and at best a
couple of inches of water supplied only by rains and dews, F below with
Amphianthus pusillus, discovered by W. M. Canby ~~& observed~~ observed since by A Gray and
myself, maturing in May and June. ♀ see next page The trunk is unusually flat and
only slightly ~~& scarcely~~ grooved underneath and on one side, only
about ½ to 1 line thick and 2 to 4 lines in the longer and not much more
than half as much in the shorter diameter; leaves distichous ~~& the~~
~~only species in which this arrangement~~

F and completely dried up and baked for weeks and or months
under the action of the glaring southern sun on the bare rock, when
only the little shrivelled trunks ~~withered~~ with their black withered matted roots remain, to
revive under a fresh supply of autumnal rains;
soft and slender, their dissepiments consisting of only 2 layers of
cells. The sporangia, ½ to ¾ line wide, readily separate from
the capbases so that they are sometimes found adhering to the trunk.

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after the leaf itself has already fallen away. The macrospores, only 8 to 20 in each sporangium, are black when moist and dark gray when dry; in some I find the warts much smaller than in others, but never wanting; microspores also quite dark brown.

insert on last page ♀ A cake of roots ~~and bulbs~~ taken home with me began to sprout
~~started~~ soon after being moistened and vegetating in the room through winter fully developed in early summer and afforded a fine opportunity for studying this curious little species, interesting on account of its native locality, its endurance of drought, its mode of growth and the phyllotactic arrangement of its leaves, its entire velum and its dark spores; it seemed to thrive best, when only the base of the leaves was covered with water. The trunk of

** with peripheral bast bundles.

† Velum partial.

9 *S. Engelmanni*, A. Braun. Our largest species with numerous (25 to 100) long (9 to 20 inches or more) light green leaves with abundant stomata; sporangium usually oblong to linear-oblong, unspotted; velum narrow; ligula elongated from a triangular base; macrospores 0.40 to 0.52 mm thick, delicately reticulated; microspores 0.024 to 0.028 mm long, generally smooth. — Flora l. c. (~~Engelm. in~~ Gray Man. l. c. Am. Journ. l. c.)

Var. *gracilis*, Engelm. Often submerged, with fewer (8 to 12) leaves, 9 to 12 inches long; the bast bundles sometimes quite small, or only

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two of them. — Gray Man. l. c.

Var. valida, Engelm. The stoutest of all our Osm species; leaves 50 to 100 or even 200, 15 to 25 inches long, keeled on the upper side; sporangium often linear-oblong (4 to 9 lines long), $\frac{1}{3}$ or often $\frac{1}{2}$ or even $\frac{2}{3}$ covered by the broad velum; macrospores rather smaller, 0.32 to 0.48 mm thick, microspores 0.024 to 0.027 mm long, spinulose. — Gray Man. l. c.

Var. Georgiana similar to the type; leaves few (in the only specimen seen 15~, 10 to 12 inches long) rather slender; one sporangium with narrow velum; macrospores ~~with~~ larger, 0.48 to 0.56 mm thick, microspores 0.028 to 0.031 long, smooth.

In pond and ditches, immersed in mud, rarely in slow running streams, in company of the ordinary vegetation of such localities, Bidens Polygonum, Lycopus, Carices, Leersia etc; mature in Summer; probably throughout the middle States but thus far only found from Massachusetts: Arlington Rock, Alewife Brook, West Cambridge Brook, Woburn W.M Booth; ~~Connecticut~~: Rhode Island: Hampton, W.G. Farlow; ~~Connecticut~~: Meriden, F. W. Hall, to New York: Peekskill, W.H. Leggett; New Jersey: E. Durand, C. F. Austin and others; Pennsylvania: Bethlehem, C.J. Moser, E Durand, S. Wolle, Delaware Water Gap, S.W. Kripe, Darby J.G. Hunt, Philadelphia E. Durand, C.E. Smith and others; Delaware: Wm M. Canby, A. Commons; Virginia: Salt Pond Mountain, W.M. Canby; with Parnassia asarifolia,

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Missouri: St Louis, N. Riehl and J. Engelmann, 1842 in a single locality, where it was soon afterwards destroyed by cultivation; not found otherwise west of the Alleghany Mountains. Var. gracilis seems to be a northern form: New Haven in fresh water on a tidal shore, D C. Eaton; New Port, Bridges, J. Thurber; Brattleborough, in Clarks Pond, C. C. Frost; Colebrook, in a shallow stream with gravelly bottom, S. W. Robbins; Passaic River near low water mark, J. Ennis. Var. valida was discovered in Pennsylvania near Warrior's Mark, Huntington Co, and Smithville, Lancaster Co, J. C. Porter, and in Delaware, Wilmington, W. M. Canby. Var. Georgiana comes from a mountain stream in Georgia, A. W. Chapman.

The trunk of this species is larger than I have seen it in any other and more variable in form; sometimes it is quite flat and over one inch wide, especially in var. valida; or it is thick, and I have seen it even twice as high as it was wide, 4½ lines wide in the largest transverse diameter and 7 lines high; this however is a very unusual form. The plant is ~~appears~~ submerged in Spring with the leaves partly floating; later, when the water recedes, the older leaves are ~~usually~~ spread out on the mud but the later growth becomes erect; var gracilis is often more or less submerged and its weekly development is probably owing to this circumstance, while var. valida is the stoutest form we have and one of the stoutest in the whole genus, perhaps only S. Malinverniana of the ricefields of Lombardy surpassing

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19 6 — after I. Engelm.

(10625)

10. I. Howellii, Engelm. n.sp. middle sized, leaves bright green (5 to 8 inches long) with thick dissepiments; sporangium oval (1½ to 2½ lines long, unspotted, ¼ to ½ covered by the velum); subulate ligula as long as sporangium; macrospores 0.43 to 0.48 mm. in diam. rough with prominent rounded single or some-times confluent tubercles.

Border of ponds at the Dalles of the Columbia, Oregon, J. & T. J. Howell, Aug. 1880, not quite mature in August v. — I insert this species which has just been communicated to me through the kindness of Mr G. E. Davenport, while the manuscript is in the hands of the printer; this must excuse some discrepancies in the foregoing pages, where no reference could be made to it. — The new species is distinguished from the similar I. Bolanderi by the longer leaves, larger more prominently marked macrospores and especially by the distinct peripheral fascicular bundles, which place it near the ~~last~~ foregoing one, and by the thick dissepiments consisting of 4 to 6 layers of cells and by the unusually narrow and long ligula; the tubercules of the spores are quite prominent as high as they are wide, rounded at top; microspores were not mature in my specimens. — Among the specimens of this species and probably collected with them I find a single one similar in the structure of the leaf but without a trace of a velum, the sporangium being entirely naked and only attached by the median line to the leaf base; it is unfortunately immature, and can

even

only be indicated as a probably new species, I. nuda. This would
not be the first instance of two species growing together in the
same pond or lake; in Mystic Pond we find I. Tuckermani and
~~I. Brauniivar echi~~ I. echinospora var. Braunii, in Echo Lake the latter
and I. lacustris and in Europe not rarely this with I. echinospora.

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only 5 inches high,
it. A very small form, has been collected in a springy place
on a rocky hillside near Wilmington, Del. by A. Commons, ~~only~~
~~5 inches high~~, otherwise not distinct. The Georgia ~~form~~ variety, characterized
by its larger spores, ought to be further studied. In my Missouri
specimens I find among many ~~a~~ ~~with~~ the of the ordinary type with white
sporangium a few where this organ is uniformly brown, not ~~or~~ spotted.
The segments of the leaves consist, the median of 3 to 4 and the
transverse one of 2 to 3 layers of cells. The well marked reticulation of the
macrospores is formed of very ~~thin~~ ~~&~~ fragile lamina not of thick ridges as
in some other species.

(small type) ++ Velum complete

10. I. flaccida, Shuttleworth in sched. A slender ~~often~~ or plant
of light green colour, leaves often very long, 10 to 35 in number,
15 to 24 inches long, sometimes entirely submerged or partly
floating on the surface, or entirely emersed; sporangium oval, 2 to 3
times long, entirely covered by the velum; macrospores 0.30 to 0.42
mm in diam. ± covered with many or rarely few comparatively
large flattish tubercles, distinct or confluent into labyrinthiform
wrinkles; microspores not seen. — A. Braun in Flora l.c. Amer.
Journ. l.c. Chapm. Fl. S. States p. 602

Var. rigida, a smaller form with still more slender erect
darker green leaves (about 10 to 15 in number, 5 to 6 inches long), ~~from~~

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Var. Chapmani larger, light green, leaves floating (about 30, 18 inches long); sporangium orbicular; spores larger, macrospores 0.44 to 0.55 mm in diam. marked as the type, or, especially on the upper side, almost smooth; microspores 0.027 to 0.030 mm long; slightly papillose.

Florida on the muddy bottom of Lake or swamps, first found by A. Regel in Lake Immonia, north of Talahassee, lately rediscovered by Mr. A. P. Garber in a hammock near Manatee on the muddy border of shallow ponds in water from a few inches to 1½ feet deep, the long leaves floating or spread out on the mud, the inner ones erect, mature in April and May, disappearing in June. Var. rigida was found by the same collector on the wet borders of Lake Flirt, not far from Lake Okeechobee, in August, entirely emersed and erect. Mr. A. H. Curtiss seems to have met with a similar form in a muddy swamp on Indian River, none of all these had any mature microspores. Var. Chapmani was discovered by Mr. A. W. Chapman in a lakelet of pure limestone water about 1 foot deep near Mariana, west Florida, ~~its large macrospores sometimes quite smooth~~, distinguish it from the other forms. This peculiar species ~~seems to be~~ the only one thus far found in Florida ~~but it~~ is distributed over the whole state: It can

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~~Aegium orbiculare~~,

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not be classed with the submerged species, for though evidently often in deep water, the leaves elongate and seek the surface and float on it. The closed velum and the peculiar sculpture of the macrospores readily distinguish it from its allies.

C. Terrestrial species, maturing when entirely out of water, with thick dissepiments and small air cavities abundant stomata and peripheral vascular bundles, & in the nearly triangular leaves. Small type

* Velum partial or almost wanting.

11. ~~Isoetes~~ melanopoda, J. Gay. Polygamous with a subglobose deeply bilobed trunk; leaves slender, stiff erect, bright green, usually black ~~blue~~ at base (15 to 60 in number, 5 to 10 or rarely even 18 inches long); sporangia mostly oblong (2 to 4 or even 5 lines long) spotted, with narrow velum, ligule triangular-subulate; macrospores among the smallest in the genus, 0.25 to 0.40 in diam. with depressed tubercles often confluent into wormlike wrinkles, or almost smooth; microspores also smaller than usual, 0.023 to 0.028 or rarely 0.030 mm long, spinulose. Gay and Durieux in Bullet. l.c. Gray Man. l.c.

Var. pallida. A larger plant, with leaf-bases pale, velum usually much broader, covering 1/4 or 1/3 of the sporangium, macrospores only 0.30 to 0.35 mm thick.

An exclusively western species, in low prairies and fields overflowed with at least 1 inch of water in spring, or in shallow ponds which dry up in summer, in stiff clayey soil, & in company of the ordinary vegetation of such localities,

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e.g. Nasturtium sessiliflorum, Hypericum mutilum, Elatine, Penthorum, Ludwigia, Ammannia, Alisma, Juncus etc, from northern and central Illinois, Ringwood, G. Vasey, Athens, Menard Co. E. Hall to Clinton, Iowa, G. Vasey, the Indian Territory, in low places in the saline flats near Limestone Gap, G. D. Butler and to the wet pinewoods in Hempstead & and about Houston, Texas, where the variety occurs, E. Hall. maturing in June or beginning of July, ~~Disappearing in July.~~ on his farm in 1853

V— Mr Hall was accidentally led to the discovery of this plant V by finding ~~the bulbs~~ its trunks and spores ~~of this plant~~ in turning up the soil for brick-making; ~~in 1853~~ and has he has since made many interesting observations about it; he does not find it every year, thus V there were none at all in 1877 1877 though the season was wet in localities where before and since it abounded another time he found it copiously only in plow furrows in a meadow, and none elsewhere; in wet seasons, when the water is deeper than usual, about the plants the leaves become longer more floccid and even decumbent and the spores mature later or not at all. In ordinary seasons the leaves disappear entirely in July and nothing but the trunks remain, and ~~with~~ about them the numerous spores, both of which are eagerly sought after by mice and other animals. The spores germinate when ever sufficient rain falls in the later summer months and perfect meadows of young plantlets can be observed in wet autumns. V ~~In the~~ Sometimes the plants are seen V as fresh in September as in May, and already 4 to 6 inches high, and in

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